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AASERT: spacial and temporal variability in nutrient patterns, productivity and algal species

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13. ABSTRACT (Maximum 200 words)

This award funded a graduate student to complete analysis of data obtained during cruises made during the ONR funded TOPO ARI cruises (1989-1991) to Fieberling Guyot. The analysis specifically addressed a) using the dominant pigments to identify the phytoplankton groups contributing to productivity station by station, to examine if there were differences above, on the side and away from the seamount, and b) identifying the nutracline at each station using detailed nanomolar and micromolar measurements, and overlaying the fluorescence maxima data to compare relative nutracline/chlorophyll maxima relationships of Fieberling with those at shallower topographical features. N-15 uptake showed that depth-integrated values of ammonium uptake were greater than for nitrate-the ecosystem is a recycling microbial loop system. The pigment data supported this with pigments characteristic of small-celled autotrophs (typically that use ammonium as a nitrogen source rather than nitrate), dominating after chlorophylls a and b, i.e. zeaxanthin (contained by phycobilin-containing cyanobacteria); 19-hexanoyloxyfucoxanthin (characteristic of the prymnesiophytes) and 19-butanoyloxyfucoxanthin). As predicted fucoxanthin, the characteristic pigment of diatoms (the major new productivity engines of the ocean that are usually large cell-sized and take up nitrate) and peridinin, characteristic of dinoflagellates were uncommon. Fucoxanthin was found in flank station samples rather than over or away from Fieberling.

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**AASERT: SPATIAL AND TEMPORAL VARIABILITY IN NUTRIENT PATTERNS,
PRODUCTIVITY AND ALGAL SPECIES COMPOSITION, OVER PACIFIC SEAMOUNTS.**

GOAL: To understand how nutrient concentrations and phytoplankton composition determine new production in the ocean, and how bottom topography influences this.

SCIENTIFIC OBJECTIVE

To describe the nitrogen productivity and dominant phytoplankton in the assemblages occurring over a deep topographical feature Fieberling Guyot, and two more shallow features, Northeast Bank and Sixtymile Bank.

APPROACH

This award funded a graduate student to complete analysis and synthesis of data obtained during cruises made during the ONR funded TOPO ARI cruises (1989-1991), produce data reports with figures illustrating data distributions, and prepare a collaborative manuscript with D. Wiesenbergs (another PI from the original cruises) who was responsible for HPLC-pigment and CTD (conductivity, temperature and depth) measurements. The data analysis specifically addressed:

- a) using the dominant pigments to identify the phytoplankton groups contributing to productivity station by station, and examine if there were differences above, on the side and away from the seamount feature.
- b) identifying the nutracline at each station using detailed nanomolar and micromolar nutrient measurements, and overlaying the fluorescence maxima data and compare relative nutracline/chlorophyll maxima relationships of Fieberling with those at shallower topographical features.

SCIENTIFIC RESULTS AND TASKS COMPLETED

PH.D. graduate student Tom Hayden was the AASERT student on this project. He made some progress towards our overall objectives but due to family difficulties followed by an offer of a science-reporting job at Newsweek he left prematurely and was unable to complete the project. Unfortunately I moved our lab to San Francisco State University (which only takes Masters levels students) and we were unable to find an appropriate American PhD student/candidate to take over the project (as directed by the AASERT guidelines). However Tom did attend the ASLO-AGU Ocean Sciences meeting in San Diego, 1996, and a preliminary draft manuscript is available for the 1989 data. He also prepared preliminary data reports incorporating all our data and CTD and pigment data in graphic format such that such that relationships between the nitrate maxima and pigment maxima for each station that was sampled can be evaluated. We were unable to obtain the CTD data Dr. Wiesenbergs in a format that we could use easily but we have graphic representations of the casts that can be used in publications. Depth integrations have been carried out for all stations and average and mean profiles for the different locations (i.e. away, over and flank of Fieberling, or Sixtymile Bank or NE Bank) and different years.

The draft manuscript (joint with Dr. Denis Wiesenberg) describes the oceanographic regime (i.e. CTD, nutrients, productivity and pigments) around Fieberling during the 1st cruise -where we had the best spatial sampling. This draft incorporates the HPLC pigment results (vertical profiles) to show the major autotrophic groups that dominate the pigment signature. The pigment signature was dominated by chlorophyll a and chlorophyll b (the latter was rare in surface samples, followed by pigments characteristic of small-celled autotrophs that might be expected to use ammonium as a nitrogen source rather than nitrate. In fact N-15 studies showed that integrated values of ρNH_4 (i.e. ammonium uptake) was greater than ρNO_3 (nitrate uptake)- the system is a recycling system typical of microbial loop/small celled oceanic organisms. The surface and chlorophyll maximum were dominated by zeaxanthin (a pigment contained by phycobilin-containing algae-most likely cyanobacteria); 19-hexanoyloxyfucoxanthin (a characteristic pigment of the golden brown prymnesiophytes) and 19-butanoyloxyfucoxanthin (characteristic of the chrysophytes). As we predicted fucoxanthin, the characteristic pigment of diatoms (the major new productivity engines of the ocean that are usually large cell-sized and take up nitrate) and peridinin, characteristic of dinoflagellates were not common. Fucoxanthin was found in flank station samples rather than over or away from Fieberling. The present plan is to complete the manuscript without CTD data for submission to DeepSea Research in 1999.

SIGNIFICANCE

Even now, almost 10 years since the data was collected our data set for Fieberling collected as part of the Abrupt Topography ARI is still a unique data set with the only nitrogen productivity and HPLC-phytoplankton pigment data collected from over a seamount. The manuscript in progress will be the first to tie hydrographic, nutrient, chemotaxonomic pigment data and measurements of total, new, and regenerated productivity in a 'blue water' location influenced by a submerged topographical feature below the euphotic zone.